A critical appraisal of "The Efficacy of Gait Training Using a Body Weight Support Treadmill and Visual Biofeedback in Patients with Subacute Stroke: A Randomized Controlled Trial"

By

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Abstract

The purpose of this critical appraisal is to examine the research conducted by researchers from the Institute of Physiotherapy, the Clinical Rehabilitation Ward of Province Hospital No. 2 and the Center for Innovative Research in Medical and Natural Sciences in Rzeszow, Poland. This article was selected to answer the clinical question: Does the use of biofeedback in physical therapy treatment speed up rehabilitation following a stroke? The purpose of the researchers' study was to determine if the use of a body weight support (BWS) treadmill with visual biofeedback would lead to greater improvements in gait in subacute stroke patients compared to using a BWS treadmill without visual biofeedback. Each section of the article was analyzed and the strengths and weaknesses of each were discussed, with the ultimate conclusion that this article provides sufficient evidence to rule out visual biofeedback as an effective tool for improving gait in subacute stroke patients.

Key words

Visual biofeedback, gait, stroke, rehabilitation, physical therapy

Introduction

Critically appraising scientific literature is necessary for determining the credibility of the evidence presented in the study. This helps both physical therapists and patients consider their options from an objectively tested point of view. The purpose of this paper is to analyze Druzbicki et. al.'s clinical study regarding the use of a body weight support treadmill and visual biofeedback to help improve gait in patients with subacute stroke. This research article was

selected to answer the clinical question: Does the use of biofeedback in physical therapy treatment speed up rehabilitation following a stroke?

Methods

The databases PubMed and Physiotherapy Evidence Database (PEDro) were used to answer the previously mentioned clinical question. The keywords used in the search were “biofeedback”, “rehabilitation”, and “stroke”. Limits placed on the search include language limits (English only), full text, type of research design and publication date. The full text and type of research design limits were placed to ensure full access to the research article and ensure the types of studies being reviewed were intervention-based. This yielded around 40 articles available to review.

The article selected for appraisal was published in BioMed Research International in 2018. The authors include Mariusz Druzbicki, Grzegorz Przysada, Agnieszka Guzik, Agnieszka Brzozowska-Magon, Krzysztof Kolodziej, Andzelina Wolan-Nieroda, Joanna Majewska, and Andrzej Kwolek (titles unknown). This study was conducted in Poland. This specific article was chosen for appraisal for its credibility of evidence relative to the other articles that were being considered.

Results

Summary of the study

The purpose of this experiment was to determine whether the use of a body weight support (BWS) treadmill with visual biofeedback would lead to greater improvements in gait in subacute

stroke patients compared to using a BWS treadmill without visual biofeedback. 30 patients at an early stage post-stroke were randomly assigned to either the BB group (the group exercising on the BWS treadmill receiving visual biofeedback), or the control group (the group exercising on the BWS treadmill without visual biofeedback). Both the BB group and the control group completed 15 training sessions during three consecutive weeks. 3D gait analysis, the 10-meter walk test, the 2-minute walk test, and the Timed Up & Go test were used to assess the progress of each patient, in addition to calculations such as symmetry index and mean velocity. Speed and step length were defined individually for each patient. Patients from both groups also received a rehabilitation program, including both individual PT and OT. Patients in both groups showed statistically significant improvements in spatiotemporal gait, walking speed, endurance, and mobility. The BB group also had a statistically significant higher improvement in range of walking speed and endurance, but the difference in improvement between the groups was not found to have clinical significance. Ultimately, it was concluded that BWS treadmill training with visual biofeedback did not lead to a significantly greater improvement in gait for subacute stroke patients.

Appraisal of the study introduction

The introduction provided clear and comprehensive background information. The authors did a good job of using literature from quality journals to depict gait abnormalities in stroke patients and describe current well-established treatments for gait training. They continued this by using additional established literature to discuss why they believe visual biofeedback can enhance gait

re-training in patients at an early stage post-stroke. The purpose of this study was easy to discern and the variables were clearly outlined. Overall, the introduction was well written.

One weakness found in the introduction was the authors were unclear regarding their conclusion of the literature review. Though the authors stated there were no up-to-date studies assessing the effects of visual biofeedback, they did not directly correlate the scientific literature cited in the introduction to the purpose of their study, or the possible clinical significance of it.

Appraisal of the study methods

This study is a prospective randomized controlled trial with a longitudinal duration and a single blind trial design. 127 patients were examined for this study, and 30 of them met the inclusion criteria and were included in the study. No subject attrition occurred, and no statistically significant differences were found regarding demographic and clinical characteristics between the groups, allowing for a direct comparison between groups without any selection bias. Though the subjects' group assignments were not concealed from the person enrolling individuals in the study, they were concealed from both the clinicians and outcome assessors. This reduces the risk of confirmation bias. All outcome measures were described in sufficient detail, and the validity/reliability for each was either mentioned or cited in the text.

The use of only 30 subjects in this study reduces the reliability and validity of the results. While there were no statistically significant differences found in demographic and clinical characteristics between groups, it is unclear if there are differences in prognostic characteristics as this was not directly addressed in the article. However, it is possible some of these might be

indirectly addressed by the inclusion and exclusion criteria provided in the Materials and Methods section. Patients from both groups also received a rehabilitation program including both PT and OT. Though all the rehab programs comprised exercises to improve the same elements (balance, stability, etc.), it is unclear how each program differed specifically. Some of the sources used were a bit older, the oldest source being from 1982. This source was used to validate the use of the 2-minute walk test for assessing individuals with a neurological condition. However, there was no mention of this validation in the referenced article.

Appraisal of the study results

The results section is written in a clear and organized manner. The findings address the hypothesis mentioned in the introduction and all outcome measures were presented in the interventions section. All figures were presented in a clear and accurate manner and made sense. Both groups showed a statistically significant improvement in spatiotemporal gait parameters, walking speed, endurance, and mobility. The BB group had a significantly higher improvement in range of walking speed and endurance. Based on my current knowledge, the improvements made by both groups in spatiotemporal gait parameters, walking speed, endurance and mobility were clinically meaningful. However, I do not believe the difference of improvement of the BB group's range of walking speed and endurance compared to the control group is clinically meaningful.

While the authors mentioned the MCID for gait speed in patients within a 20-60-day period post-stroke, they did not mention the MCID for any other variables being measured. It is also worth noting that the range of time (in days) from stroke shown in Table 1 state that the range of days

post-stroke of the patients in the study was anywhere from 5-23 days. Because of this, it is not safe to assume the MCID adopted and used by the researchers applies to this group of subjects. The NNT is not calculated or described in this study.

Appraisal of the study discussion

The authors did a great job of further indicating the meaning of the findings and using existing literature when discussing the basis for their hypothesis. The authors discuss the limitations of their study, such as a short time period for treadmill training and lack of monitoring the amount of exercise patients did on their own. The conclusion of this study is reflective of the results; the evidence did not confirm BWS treadmill training with visual biofeedback leads to a significantly greater improvement in gait compared to BWS treadmill without visual biofeedback in patients at an early stage post-stroke. These findings were not over-concluded. Further studies were suggested that implement visual biofeedback assisted gait training with balance exercises, supported with kinetic biofeedback information on the loading of the paretic limb. Another future study was also suggested to compare the effects of using advanced techniques with visual biofeedback function to other cheaper methods that provide visual/acoustic feedback during gait training. The authors state that although the evidence from their study did not support the method of visual biofeedback in gait re-training, elimination of gait asymmetry should be a goal of gait re-education at each stage of rehabilitation, including early stage post-stroke.

As stated in the critique of the methods section, some of the sources used were older, the oldest source being from 1982. This source was incorrectly used to validate the use of the 2-minute

walk test for assessing individuals with a neurological condition. However, there was no mention or validation of this in the article itself.

Discussion

This study suggests that visual biofeedback does not lead to a clinically significant difference in gait outcomes for subacute stroke patients. This study answers my clinical question by providing evidence that visual biofeedback is not an effective treatment tool for subacute stroke patients. More evidence would need to be provided to determine if this is true for stroke patients at varying stages post-stroke, and if this applies to the other movement patterns besides gait.

The evidence from this study can help the PT rule out visual biofeedback as an effective tool when creating the patient's plan of care and minimize wasted treatment time. According to this study, the only potential benefits from using visual biofeedback in gait training would be an increased range of walking speed and endurance. However, the amount of improvement compared to the control group was not found to be of clinical significance. While I do not believe there are any indicated risks when using this method of intervention, it does not make sense to use a more expensive, complex intervention when the standard method of intervention produces the same results. The lack of potential benefits leads to me conclude this intervention should not be used in the clinic.

As stated in the article, gait impairment is a huge problem for stroke survivors. Although this study alone is not enough to convince me there is no possible benefit of the use of visual biofeedback in gait re-training, it is enough for me to say I am comfortable with using the

standard method of gait re-training, rather than utilizing visual biofeedback. Knowing there were no clinically significant differences in the outcomes of patients who used biofeedback versus those who did not means you can use less equipment and produce the same result, while the patient is billed for less.

This article effectively answers the proposed clinical question “Does the use of biofeedback in physical therapy treatment speed up rehabilitation following a stroke?”. The authors used established literature as a basis for the study’s hypothesis and for the discussion of the results. The methods used to collect data were valid and clearly described in enough detail to replicate. The results were clear, organized and addressed the research question being posed. The conclusion was appropriately drawn from these results. This article provides sufficient evidence to rule out visual biofeedback as an effective tool for improving gait in subacute stroke patients.